memorandum

Environment and Resources Division

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To Todd Doley, US EPA

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Subject Literature review of hedonic property value analyses of stream restoration and soil erosion mitigation

1 Introduction

This memorandum reviews hedonic property value studies which estimate the changes in property value due to either stream restoration or to on-property soil erosion mitigation. Stream restoration includes a variety of activities which may produce amenities valued by nearby homeowners, including improved in-stream channel conditions and natural flow regime restoration (which reduce the risk of property erosion), and riparian buffers (which improve aesthetic amenities). Mitigating erosion on individual properties would also be expected to increase property values; restoring eroded areas may enable a homeowner to use more of their property in a preferred use (i.e., lawn), and some erosion mitigation practices (i.e., vegetation based BMPs) may provide aesthetic benefits.

This memorandum summarizes studies from previous literature reviews and from our current literature review. In previous reviews, we focused on literature evaluating economic values for endpoints associated with stream restoration and erosion mitigation. We completed these reviews under WA 01 and WA 06. Collectively, the three prior reviews examined more than 70 studies published through 2011.Specifically, our aim in these efforts was to:

- Broadly examine the literature summarizing water quality impacts on property values (Abt Associates, 2010).[1] This review identified a number of studies measuring specific values relevant to the water quality results of LID practices, and found positive home values related to stream restoration and reductions in erosion.
- Complete a focused review of studies estimating the economic value of stream restoration (Abt Associates, 2012).[2] In this review, we identified several studies evaluating endpoints related to stream riparian and/or stream-bank conditions, but generally found that most existing hedonic studies of stream restoration evaluated contexts dissimilar to

[1] Abt Associates, Inc. September 9, 2010. "Literature Review on the Effect of Water Quality Impacts on Residential Property Values." [Memorandum, WA 0-01]

[2] Abt Associates, Inc. February 27, 2012. "Additional studies valuing river, stream, or riparian area restoration." [Memorandum, WA 3-06].

development-related stream impairment. We also summarized studies using stated preference valuation methods.

- Identify hedonic property value studies of open space which were ultimately used in Abt Associates' recent meta-analysis of open space property values (Abt Associates, 2012).[3] Results of the meta-analysis suggest proximity to riparian open space contributes positively to residential home prices.

In our current search for new or additional studies related to stream restoration and soil erosion, we reviewed studies available in several pertinent databases (e.g., EconLit, AgEconSearch, and Science Direct) and conducted a general web search for key terms (Google Scholar). We found only four additional studies pertinent to the post-construction context and using hedonic property value methods.

1.1 Stream Restoration

Previous reviews had identified 13 hedonic property value studies estimating the economic value of stream, river, and riparian area restoration methods (Table 1). The current review identified two additional studies examining property value effects of stream restoration (Hellman, 2011; Huang, 2012), for a total of 15 studies (Table 1). The new studies examine home prices in context of nearby urban stream conditions. Water quality endpoints in these studies are relevant to stream restoration activities tied to use of LID or other stormwater management measures: Hellman (2011) examines average annual stream flow volumes, and Huang (2012) examines stream bank condition.

Ten of the previously-identified studies could also provide a suitable context for development-related stream impairment. Seven studies evaluate riparian and/or stream-bank conditions and three evaluate in-stream water quality endpoints. Three remaining studies would not provide suitable contexts, as endpoints associated with acid mine drainage,dam removal, and National Scenic Rivers do not parallel those likely achieved with LID implementation.

1.2 On-property Soil Erosion

None of our prior literature reviews summarized studies specifically examining homeowner willingness to pay for on-property soil erosion mitigation. In the current review, we find the literature examining the residential property value impacts of mitigating on-property soil erosion is not substantial, particularly in the context of erosion processes tied to urban stormwater runoff. We identified 8 new studies (Table 2).Of these 8, two evaluate contexts similar to the type and scale of erosion caused by urban stormwater runoff (and conversely, mitigated by the adoption of stormwater management practices). Of the two (Cunningham, 2007; Dorfman, Keeler, & Kriesel, 1996), only Dorfman, Keeler & Kriesel (1996) examine monetized values for erosion risk. Dorfman Keeler & Kriesel study erosion on lakefront properties, first estimating erosion risk to waterfront properties, where erosion risk is the likelihood of undertaking significant expenditures

[3] Abt Associates, Inc. November 30, 2012."Meta Analysis Application and Results." [Draft report chapter, WA 3-01].

to mitigate erosion damage and is a function of natural wave action, a homeowner's use of shoreline protection devices, and the age (effectiveness) of any protection devices. [redacted] Hedonic regression results suggest that homeowners are willing to pay up to 30% of housing prices to reduce the annualized probability of erosion risk to zero.

The remaining six studies address two types of erosion that are each dissimilar to the urban stormwater runoff policy scenario: beach erosion and agricultural erosion. The bodies of literature related to each of these outcomes (agricultural soil and beach width) are more extensive than what we report in this memo. However, since post-construction stormwater management activities are unlikely to affect either outcome, we simply note that the studies discussed herein appear generally representative of the methods and results in other studies. These groups of literature are discussed briefly in the bullet points below.

- We identified three studies related to on-property agricultural topsoil erosion related to tillage activity. While these studies generally reveal negative impacts of soil erosion on agricultural land values, the agricultural context is dissimilar from the case of commercial, industrial, and residential development.
- We identified three studies examining changes in residential property values adjacent to ocean beaches experiencing beach width erosion. Beach width erosion is, in part, caused by changing coastal geomorphology due to coastal development; however, homeowners' values for beaches likely include significant recreational amenities, and are unlikely to represent nation-wide values for preventing erosion in residential areas.

Table 1. Studies Examining Property Value Effects of Stream, River, or Riparian Restoration.

New	Authors	Affected Resource	Context	Location	Ecological Endpoint	Affected Population
Yes	Hellman (2011)	Urban Stream	Urban stormwater runoff quantity	USA (NY)	Average annual runoff volume in the year prior to a sale, as a proxy for flooding frequency	Riverfront homeowners within FEMA flood boundaries
Yes	Huang (2012)	Urban Stream	Urban stream restoration projects	USA (TX)	Stream bank and other visual indicators of tributary restoration project outcomes, observed before, during and after restoration project	Riverfront and floodplain homeowners
No	Bark et al. (2009)	Riparian area	Habitat quality of riparian vegetation	USA (AZ)	Indices of riparian vegetation biomass, upland connectivity, wetness, diversity	Nearby homeowners
No	Bark et al. (2011)	Riparian area	Riparian vegetation/ "green-ness"	USA (AZ)	Vegetation index on lot, nearby riparian area, and subdivision	Nearby, riparian homeowners
No	Bin et al. (2008)	Riparian area	Mandatory riparian buffer maintenance rule instated	USA (NC)	Joint effect of riparian location (0/1) and time trend (riparian buffers mandatory, or not)	County homeowners
No	Cho et al. (2011)	Riparian area	Ambient water quality due to paper mill pollution	USA (NC & TN)	Impairment status (0/1): is nearest reach on the 303(d) impairment list?	Residents in communities with or without economic stake in mill
No	Colby & Wishart (2002)	Riparian area	Proximity to one riparian corridor	USA (AZ)	Marginal change in distance to centerline of a 15-mile long riparian corridor	Homeowners within 2.5 miles of corridor
No	Czajkowski & Bin (2010)	Estuary, tidal river, and bay	Estuarine, tidal river, and bay water quality	USA (FL)	Ambient water quality; as indicated by either technical measures (visibility, temp., salinity, pH, D.O.) or non-technical rating (good, fair, bad).	Waterfront homeowners
No	Dornbusch & Barrager (1973)	River, stream, and other water bodies	National waterways restoration	USA (CA, OR, PA, WA, WV)	State of the world before or after (0/1) pollution abatement (difference in before/after based on fecal coliform, visual and other pollutants and varied by site)	Nearby property owners; case study values then extrapolated to all US waters
No	Lewis et al. (2008)*	River	Hydropower dam removal	USA (ME)	State of the world before/ after dam removed (0/1)	Riparian homeowners

New	Authors	Affected Resource	Context	Location	Ecological Endpoint	Affected Population
No	Mooney & Eisgruber (2001)	Riparian area	Riparian tree buffers	USA (OR)	Width of riparian buffer on streamfront properties (ft)	Riparian homeowners
No	Poor et al. (2007)	River	Ambient water quality	USA (MD)	Total suspended solids, dissolved inorganic nitrogen (each in mg/L)	Watershed homeowners
No	Streiner & Loomis (1996)	Urban Stream	Urban stream restoration projects	USA (CA)	Presence or absence (0/1) of one or more of the following qualitative changes: fish habitat restoration, land acquisition, establishment of education trail, flood damage reductions, clean-ups, clearing of stream obstructions, revegetation, and aesthetic improvements.	Homeowners near each restored stream
No	White & Leefers (2007)*	River	Rural properties' proximity to river and streams	USA (MI)	Distance to local streams and a National Scenic River (not significant when also accounting for distance to forest, lake, and public lands)	Regional homeowners
No	Williamson et al. (2008)*	Stream	Acid mine drainage (AMD)	USA (WV)	Compare streams with and without (0/1) TMDL for AMD, and distance to stream	Nearby landowners

Notes: (*) Denotes studies not applicable to post-construction stormwater management policy context.

Table 2. Studies Examining Property Value Effects of Erosion.

New	Authors	Affected Resource	Context	Location	Endpoint	Affected Population
Yes	Cunningham (2007)[1]	Urban growth boundary	Erosion risk	USA (WA)	Role of erosion risk in increasing or decreasing an undeveloped parcel's hazard of development.	Property owners
Yes	Miranowski & Hammes (1984)*	Agricultural land	Soil erosion	USA (IA)	RKLS factor-- Farmland soil erosion potential (ton/ acre)	Agricultural land owners
Yes	Gardner & Barrows (1985)*	Agricultural land	Soil erosion	USA (WI)	Proportion of land plowed in contours (erosion control BMP)	Agricultural land owners
Yes	Palmquist & Danielson (1989)*	Agricultural land	Soil erosion	USA (NC)	RKLS factor-- Farmland soil erosion potential (ton/ acre/ year)	Agricultural land owners
Yes	Gardner (1985)*	Agricultural land	Soil erosion	USA (WI)	Property classification based on erosion severity (percent of topsoil lost, etc).	Agricultural land owners
Yes	Dorfman et al. (1996)	Great Lake	Shorefront property erosion prevention expenditures	USA (NY)	Reduction in the risk of spending significant money to remediate shorefront property erosion	Lakefront homeowners
Yes	Ranson (2012)*	Ocean coastline	Beach width	USA (FL)	Marginal changes in beach width	Beachfront property owners
Yes	Gopalakrishnan, Smith, Slott, & Murray (2009)*	Ocean coastline	Beach width	USA (NC)	Erosion rates; variable costs of replacing eroded beach sand.	Beachfront property owners

Notes: (*) Denotes studies not applicable to post-construction stormwater management policy context.

2 References

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